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REDUCING BARRIERS IN THE ADULT AMBULATORY SURGERY SETTING BY
IMPLEMENTING LEAN METHODS

Submitted to the Faculty
Yale University School of Nursing

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Nursing Practice

Leonid Gorelik

May 15, 2015

The capstone is accepted in partial fulfillment of the requirements for the degree Doctor of Nursing Practice.

Judith Kunisch, MBA, BSN

May 15, 2015

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May 15, 2015

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Signed: Leonid Gorlik

May 15, 2015

Title of Manuscript: Reducing Barriers in the Adult Ambulatory Surgery Setting by Implementing Lean Methods

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Conflicts: None to declare.

Abstract

Process impediments and patient flow interruptions in the preoperative setting affect patient care quality and increase organizational costs through inefficient use of operating room time. Lean methodology was successfully applied to improve efficiencies, patient privacy, and quality of care in a hospital-based high-volume adult ambulatory surgery unit. Process improvement strategies were identified and carried out during a rapid process improvement workshop (RPIW), and significant process changes were made to the preoperative work areas.

Introduction

Quality, cost, and access problems are prime reasons why health care industry leaders called for healthcare reform. Since the release of the Institute of Medicine (2000) report, *To Err is Human: Building a Safer Health System*, there has been a strong push by health care consumers, payers, and local, state, and federal governments for key stakeholders in health care organizations to improve the delivery of quality care. (1) As a result, there is a growing interest in use of evidence-based process improvement methods in healthcare organizations. Application of disciplined operations research and process improvement tools in other service industries demonstrated clear benefits in quality outcomes. (2) Subsequently, similar processes were applied in healthcare delivery with comparable benefits. According to the Institute for Healthcare Improvement, Lean process improvement methods successfully impact quality, cost, and access problems in healthcare organizations. (3) Furthermore, a systems approach using Lean process improvement methods aids hospitals in meeting The Joint Commission (TJC) standards for safe and efficient patient flow. TJC recognizes that “patient flow problems pose a persistent risk to the quality and safety of care”. (4) Hospitals are challenged to systematically address this problem. Proven strategies have been adopted in healthcare from the aviation industry to improve patient care quality and safety including the use of checklists and team training. (5) Lean process improvement methods originating from manufacturing can also be applied to improve patient care quality and safety in healthcare.

Lean Framework

Lean methods are used in healthcare settings to decrease waste and improve workflow efficiency among healthcare staff. In literature, Lean is operationally defined as a five-step process for guiding implementation of process improvement strategies. According to Womack & Jones (6) the five steps are:

1. Specify value from the standpoint of the customer.
2. Identify all the specific activities required to bring a specific service to the customer and eliminate activities that are wasteful.
3. Make services flow continuously towards the customer.
4. Establish customer pull rather than pushing services onto the customer.
5. Continue the process until a state of perfection is reached in which value is created with little to no waste.

According to Fairbanks, Lean initiatives are “identified by members of a designated team and facilitated by a team leader. The team walks through every step of major processes, measuring time, identifying activities and making rapid improvements through the elimination of wasteful activities”. (7) Lean thinking derived from Lean manufacturing, which originated from the automotive industry and came about as a result of Toyota Motor Sales Company’s pursuit of providing to its customers a high-quality product at a competitive price. (8) The pursuit resulted in the birth of the Toyota Production System (TPS). The basic underlying concept of TPS is based on industrial engineering principles and operational innovations that identify and eliminate any operations that do not add value to the company’s product or service from the standpoint of the customer. (9) TPS has evolved over the past fifty years and its process methods continue to be successfully implemented in manufacturing and service industries all over the world.

In 2002, Virginia Mason Medical Center (VMMC) was the first to integrate Toyota’s Lean manufacturing management principles throughout its health system. The fundamental principle behind Lean manufacturing involved the identification and elimination of seven types of waste- waste of time, motion, inventory, processing, defects transportation, and overproduction. Leadership at VMMC recognized that waste added no value to patients and served as a drag on the system. The elimination of waste would mean that patients would receive only value-added care. (10) In healthcare, as in every other service industry, value-added means the customer must be willing to pay for a service that moves the care process forward and is done correctly the first time. (11) Lean process improvement methods continue to be effectively implemented in hospitals with great success. Research on the use of Lean methods in healthcare settings shows significant reductions in non-value-added time and activities. Healthcare

Lean methods application findings include improvements in delivery of care, provider efficiency, and patient and staff satisfaction scores. Vats et al. noted that implementation of Lean methods on physician rounding led to an increase in timeliness and efficiency of rounds as well as improved staff satisfaction with the new process in a pediatric intensive care unit. (12) Additionally, the authors noted that mean rounding time decreased by 36 minutes. Furthermore, pediatric ICU patients were discharged by an average of 58.05 minutes sooner; ($P < .05$) leading to improved patient satisfaction rates. In one study, Waldhausen et al. posited that the use of Lean methods, including the use of two RPIWs, reduced variability in care and improved patients' surgical clinic experience. The authors found that the median number of patients scheduled per clinician in a 4-hour clinic increased from 10 to 12, patient-provider face-to-face time increased by 58 percent, and National Research Corporation (NRC) Picker Problem Scores improved from 14.3% to 9.2%. (13) Chand used Lean process improvement methods to eliminate waste and variation in resident rounding. The author noted a reduction in non-value-added time per patient by 64% ($P < .005$) (14). Lean methods were also successfully utilized by Niemeijer et al. to help reduce patient length of stay by 2.9 days (15). In another study, the use of Lean methods reduced the rate of healthcare-associated Methicillin-Resistant *Staphylococcus Aureus* (MRSA) infection in a surgical unit and intensive care unit by 68% ($P < .001$). (16) In the perioperative setting authors Celik et al. successfully reduced preoperative delays by 7% (53 % to 46%) by using Lean methods. (17)

A critical success factor of Lean initiatives is the make-up of the Lean team; front-line staff who do the work daily and who are familiar with every step in the "production" process. Lean process improvement methods include the use of a Rapid Process Improvement Workshop (RPIW), which is a weeklong workshop consisting of a 6-8-member team, both leaders and frontline staff, that intensely studies work focusing on improving processes identified as broken or defective (18). An 8-week long process of extensive preparation that includes obtaining approval to conduct the workshop, selecting members for the team, engaging support staff, and collecting pre-implementation data precedes the RPIW.

Methods

Study Design

This project was implemented by a member of the Mount Sinai Health system, using Lean process improvement methods at the New York Eye and Ear of Mount Sinai (NYEE). The scope of this project is a 9-week Lean initiative, which involved an 8-week preparation phase and a weeklong workshop consisting of a team of 6-8 members, both leaders and front line staff that intensely studied processes identified as broken or defective in the preoperative setting of the adult ambulatory surgery unit (ASU). To avoid scope creep during the RPIW, the team kept the focus specifically on the time from patient arrival to completion of nursing assessment.

Setting

The NYEE, founded in 1820, is the first specialty hospital in the nation. It ranks as one of US News and World Report's "Best Hospitals" in America and is Magnet Accredited by the American Nurses Credentialing Center (ANCC). The ASU at NYEE provides preoperative and postoperative care to over 25,000 patients annually. In 2013, outpatient surgery generated 73% of total operating revenue. The merger with Mount Sinai expands the healthcare system market share and is projected to increase the volume of outpatient same-day surgeries over the next three years. Application of Lean methods has been shown to improve efficiency without driving up costs in healthcare settings, eliminating the need to invest in expensive capital improvement projects. Implementing Lean methods affords NYEE an innovative, evidence-based approach yielding positive results in a timely fashion without negatively impacting the institution's bottom line.

Aims

A Lean initiative was conducted from October to December 2014 in the Adult ASU at NYEE. It involved a pre-RPIW data collection period from October to the end of November and a 5-day RPIW in the first week of December. The team consisted of 6 members of the preoperative patient care staff including: an assistant nursing care coordinator, two registered nurses, a nursing assistant, and a unit clerk. This was organized under the direction of the first author (L.G.) and the Chief Nursing Officer (S.T.). The Chief Transformation Officer at Mount Sinai St. Luke's served as a resource with expertise in the implementation of Lean methodologies. On December 1st, the team undertook a RPIW to develop a value stream map (VSM) of patient flow that detailed the event location, personnel, information technology requirement, alternative pathways, key performance elements, and bottlenecks and barriers

to patient flow. The aims for the RPIW were completed in three phases in the first week of December 2014. The aims were to:

1. Determine the preoperative patient preparation and flow process in the adult ambulatory surgery setting using steps 1 and 2 of the Lean framework.
2. Apply value stream and root cause analysis to identify processes that were broken or defective and eliminate those activities that did not create value for the patient using steps 2, 3, and 4 of the Lean framework.
3. Develop an action plan incorporating solutions targeted to improve remaining barriers to preoperative patient flow identified by the team, in order to carry out step 5 of the Lean framework.

Interventions

Prior to the RPIW, baseline data was collected on daily patient volume, wait time, dressing room cycle time, registration time, nursing, physician, and anesthesia assessment time, and pre-anesthesia testing (EKG/Phlebotomy) time (Table 1). This was completed over the course of 8 weeks from October to November 2014.

Phase 1

The team determined the preoperative patient preparation and flow process in the adult ambulatory surgery unit utilizing steps 1 and 2 of the Lean framework. In considering a patient's perspective within this process, the team identified privacy and face-to-face time with a health-care provider as value-added, whereas patient wait time and excess motion as non-value-added. The team identified and evaluated all the activities in the preoperative process by utilizing VSM. VSM provides a detailed step-by-step view of a process being targeted for improvement, illustrating both the physical and informational flow of a patient or product through the entire service line. (19) VSM highlights the barriers to flow and exposes the non-value-added steps associated with the delivery of patient care. All that was required to create a VSM was pencil and paper. This allowed the team to more easily recognize and classify each step as either value-added or non-value-added. Of the 46 steps identified in the value stream

process, 10 (21.7%) were found to add value to the patient's experience, and 36 (78.3%) were found to be non-value-added. In Lean, a value-added step is a component that is defect free, transformational, and the customer, or in our case the patient, would be willing to pay for. The creation of a VSM enabled the team to identify a total of six locations as "choke points" that cause bottlenecks in the preoperative setting. Each waiting area was categorized as a bottleneck since patient demand exceeded operational capability (Figure 1).

Phase 2

The team applied value stream and root cause analysis during the RPIW to identify processes that were broken or defective and eliminated those activities that did not create value through steps 2, 3, and 4 of the Lean framework. By applying value stream analysis, root cause analysis and creating a cause and effect (C&E) diagram (Figure 2), the team was able to further study the bottlenecks concluding that their causes were due to barriers that impeded patient flow. A root cause analysis is a process used to determine the root cause of a problem and can be simply determined by utilizing the "5 Whys" method. The "5 Whys" method is a process where the problem solver asks the question "Why?" five times in order to get to the root cause of the issue. (19) Another method used is a C&E diagram (also known as a fishbone diagram), which is a more structured approach to determining the root cause of a mistake. The C&E diagram identifies the "inputs or potential causes of a single output or effect". (19) The C&E diagram helps to organize thoughts by using a structured process that presents all possible causes of an issue. A whiteboard or large sheet of paper is taped to a wall and Post-It Notes are used to insert primary and secondary causes of mistakes on the diagram itself. (19) The team identified a total of 270 preoperative barriers during the RPIW (Figure 3). The team designed and carried out strategies to reduce the number of barriers and bottlenecks that were impeding patient flow in the preoperative setting. Using "if/then" statements, the team brainstormed solutions that reduced the number of barriers from check-in to completion of nursing assessment. A total of nine strategies were designed and implemented to reduce the number of barriers in each segment of the preoperative patient preparation process (Table 2).

Phase 3

The team developed an action plan incorporating solutions targeted to improve the remaining identified barriers to preoperative patient flow as part of the last phase of the RPIW (step 5 of the Lean framework). The team developed

an action plan listing all barriers and incorporating identified solutions in order to improve processes. An A3 report (Figure 4) was created from the Lean event for the nursing executive committee. The report outlined the key findings, lessons learned, action items, and next steps. An A3 report is a simple one-page document that guides the problem solver through a rigorous and systematic problem solving process focusing on the identification of the current issue or problem and the investigation of it through a deep understanding of the current work process. (20)

Results

Nine strategies were identified and implemented to make the preoperative process more efficient. Table 3 depicts the preoperative metrics before and after the RPIW. The mean patient preparation time, from dressing room wait time to completion of RN Assessment, was 95 minutes at baseline, 59 minutes post-RPIW and 63 minutes 30 days post-RPIW. During this time, the average surgical volume remained stable, between 100 and 120 patients. Both the wait time to the dressing room and for nursing assessment improved during this process. The initial average wait time for the nursing assessment was 44 minutes and decreased to 12 minutes post-RPIW and 17 minutes 30 days post-RPIW. This extra time allowed for longer nursing face time. The average length of the nursing assessment increased from 28 minutes at baseline to 31 minutes post-RPIW and 30 minutes 30 days post-RPIW. Additional findings included improvements in patient privacy, accuracy of care, efficiency, work environment and standardization of work processes.

Discussion

Purpose

The purpose of this project was to improve patient care quality and privacy and reduce organizational costs by identifying barriers to patient flow to the operating room using Lean process improvement methods. This project presented an opportunity for nursing staff members to identify solutions to improve patient care quality, nursing excellence and innovations in professional nursing practice.

Training

To further his understanding of the Lean process, the first author (L.G.) participated in a RPIW at Mount Sinai St. Luke's, which was overseen by the chief transformation officer, a Lean master. The group received a brief

introduction to Lean and discussed some of the most common strategies employed as part of the methodology. The group discussed the scope of the RPIW and reviewed the current situation, which was targeted for improvement. The group reviewed baseline data collected on the current situation and developed target metrics to gauge the success of the group's efforts. As part of the workshop the group went to the Genba (a word commonly used in Lean to describe the place where the work is done) to further study the current situation and engage the front-line staff not part of the work group. The group designed process improvement strategies incorporating feedback retrieved from the Genba, including creating an action plan, implementing the action plan, and then measuring its effectiveness. Together, the group intensely studied the problem using Lean strategies including: the fishbone diagram, VSM, A3 report, and time-study observations. At the end of each day, the team leader would report the day's work to the executive steering committee. Feedback from the executive committee was then incorporated into the next day's work. On the last day, the team completed a slide set presentation depicting the 5-day journey and the fruits of labor. The methodology taught in the RPIW was replicated by the first author (L.G.) at NYEE.

Recommendations

The importance of having a strong communication plan that incorporates the use of e-mail, memos, one-to-one discussions and group meetings cannot be overemphasized. The team focused on a single segment of the preoperative process; however, future study should target the entire process, as elements of each phase of care are impacted by process changes.

Process improvement does not have to translate into a long routine of meetings and lengthy approval processes. Not all process improvement efforts require a substantial budget. Throughout the RPIW the idea of “creativity before capital” was emphasized.

Conclusion

Using Lean methodology, the team was able to shorten the preoperative cycle time as well as integrate a new approach to improving accuracy of care, patient privacy and decreasing patient motion. Lean methodology can effectively be applied to improve patient care, efficiency, and privacy in an academic Magnet accredited specialty hospital ambulatory surgery setting.

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Table 1. Pre-RPIW Data Collection of Preoperative Process

Categories	Average Time (min)	Range	Sample Size (n)
ASU Floor Reception Desk*	<1	<1	25
Main Waiting Area I*	9	1-43	219
Dressing Room*	13	1-23	152
Preoperative Waiting Area II*	44	1-158	40
RN-Assessment*	28	6-95	1178
Preoperative Waiting Area III	16	5-44	7
EKG/Phlebotomy	6	4-7	10
Preoperative Waiting Area IV	16	1-45	29
Medical Clearance	7	5-20	20
Preoperative Waiting Area V	12	1-26	26
Anesthesia Clearance	6	3-12	10
Preoperative Waiting Area VI	102	14-168	15
Total	259		

* Areas targeted for improvement during RPIW

Table 2. Nine Strategies Implemented

Strategy	Action Plan	Outcome/Barriers Addressed	Follow-Up
1. Remove sign-in sheet at reception desk.	Inform reception staff and remove sign-in sheet. Reception staff will document arrival time on patient labels.	<ul style="list-style-type: none"> Improved patient privacy Decreased congestion/bottle neck at reception desk 	Adopt
2. Receptionist to print and review OR schedule to ensure 4 th floor OR patients who require 2 nd floor OR attire are flagged for the dressing room staff.	Provide reception staff with list of specific procedures that require the patient to change into 2 nd floor OR attire. Receptionist to alert (verbal/mark on patient label) dressing room staff of patients going to 4 th floor OR that require 2 nd Floor OR attire.	<ul style="list-style-type: none"> Decreased re-work when patients are changed into the wrong OR attire Decreased patient motion Improved patient flow 	Adopt
3. Dressing room staff will obtain patient VS in the patient changing rooms (RM 1-4).	Instruct dressing room staff to obtain patient's vitals in changing room.	<ul style="list-style-type: none"> Improved patient privacy 	Abandon- Not enough room in changing room for VS machine and dressing room employee
4. Label dressing rooms specific to preop patients/postop patients which will be facilitated by 3 rd dressing room attendant.	Instruct dressing room staff to use one changing room for postop patients.	<ul style="list-style-type: none"> Improved preoperative patient flow by focusing mainly on changing the preop patients 	Abandon- Influx of postop patients and not enough changing rooms leading to bottlenecks in the dressing room
5. Dressing room staff to obtain accurate patient Ht. /Wt. by using scale.	Provided dressing room staff with another scale for Ht. /Wt. measurement.	<ul style="list-style-type: none"> Improved accuracy of patient care (anesthesia medications based on Ht. /Wt.) 	Adopt
6. Dressing room staff to walk each patient to preop area once patient has changed into OR attire.	Inform dressing room staff to walk each patient to preop area.	<ul style="list-style-type: none"> Decreased patient motion Decreased patient confusion with locating the preop area. Improved patient flow by ensuring that the patient goes directly to the preop area. 	Adopt
7. Identify and label each assessment	Utilizing schematic of 5 th floor map, plot all	<ul style="list-style-type: none"> Increased patient privacy by 	Adopt

room/area available to conduct clinical assessment/intake.	possible assessment areas (12 rooms/areas identified) and label each room A-L.	limiting assessment in waiting/holding areas <ul style="list-style-type: none"> • Increased total number of assessment rooms/areas • Decreased time providers spent searching for a private room/area 	
8. Develop/design new process to ensure that VS are to be done privately in the preop setting.	Designed and implemented new process whereby the 3 rd dressing room assistant is reassigned to work in the preop area. Additionally, escorts each patient into a private assessment room/area and obtains patient's VS.	<ul style="list-style-type: none"> • Increased patient privacy • Decreased patient motion • Increased provider-patient face time 	Adopt
9. Designate preop unit clerk to determine which patients should be prioritized for the OR.	Inform unit clerk and preop staff that the unit clerk will be the central employee who determines which patient is assessed first by a provider.	<ul style="list-style-type: none"> • Improved OR utilization by better predicting which OR is or will be available 	Adopt

Table 3. Post-RPIW Metrics

Category	Pre-RPIW	Post-RPIW	30 Days Post-RPIW
Reception Desk (min)	<1	<1	<1
Waiting Area I (min)	9	5 (↓44%)	5 (↓44%)
Dressing Room (min)	13	11 (↓15%)	11 (↓15%)
Waiting Area II (min)	44	12 (↓73%)	17 (↓61%)
Nursing Assessment (min)	28	31 (↑11%)	30 (↑7%)
Total (min)	95	59 (↓38%)	63 (↓34%)

Figure 1. ASU Preoperative Patient Flow Process Map

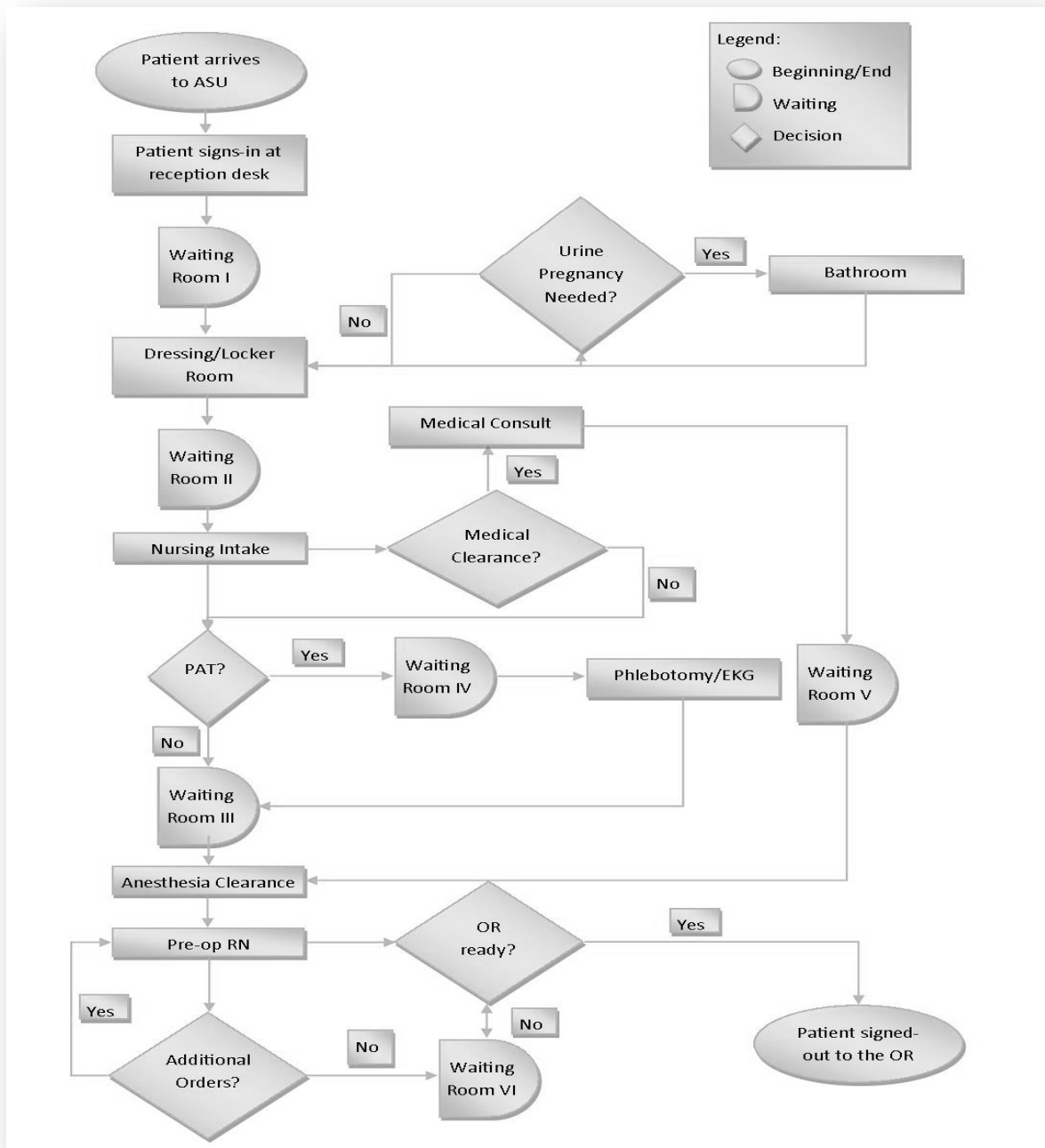


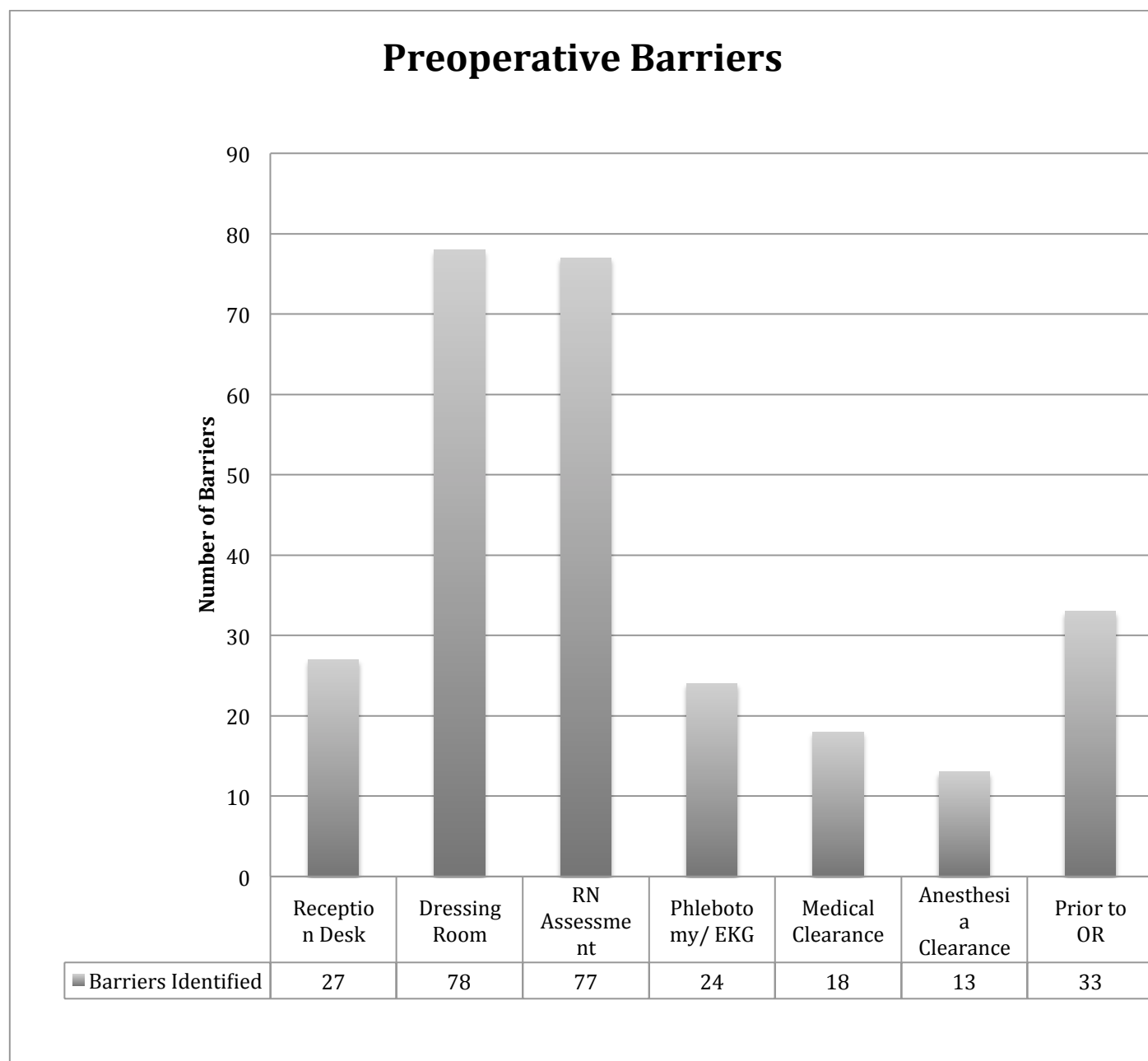
Figure 2. Preoperative Patient Flow Barriers

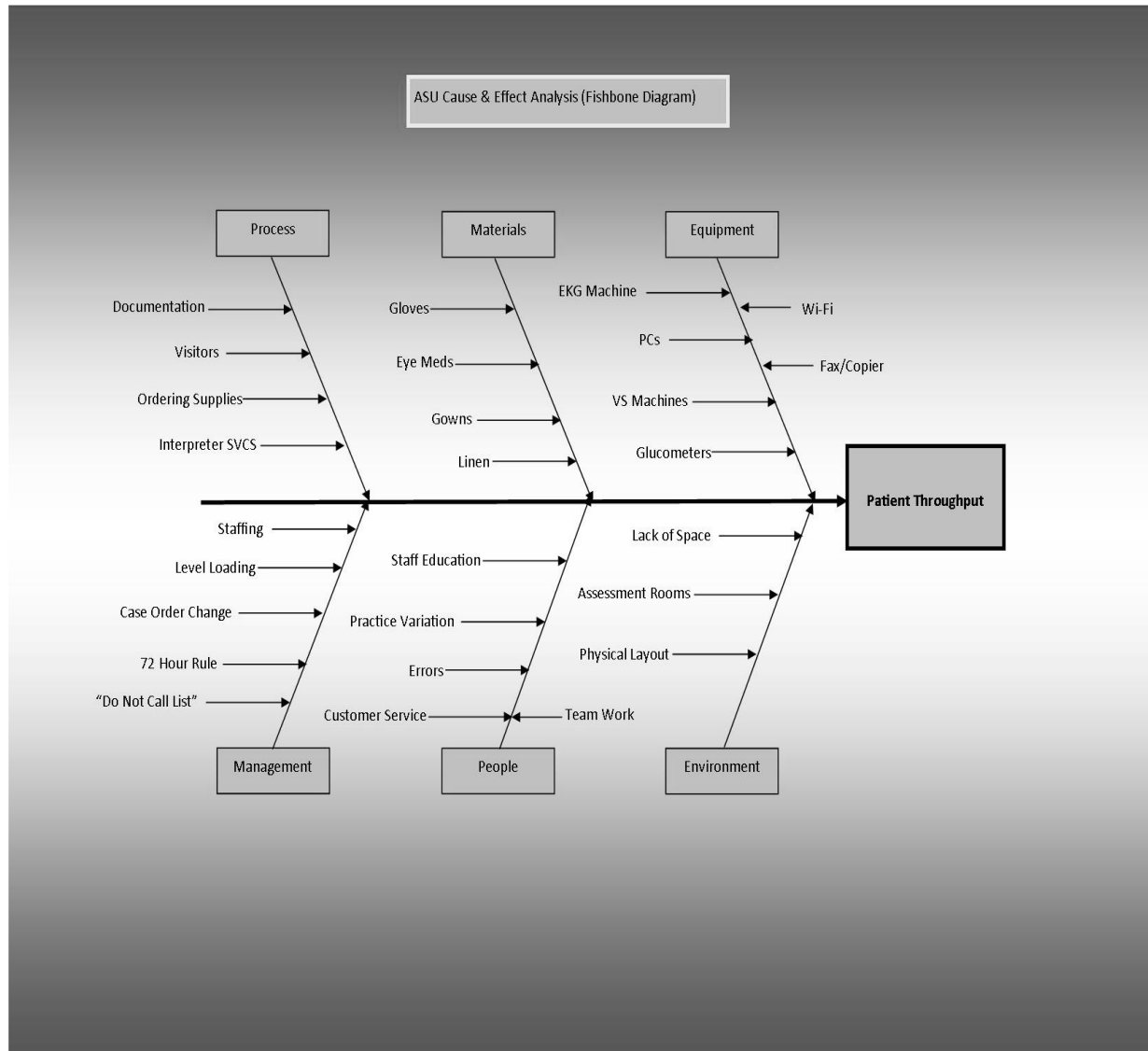

Figure 3. Cause and Effect Diagram

Figure 4. A3 Report

	A3 Name:	Katzen Event	Executive Sponsor:	Sonja Tennaro	Team Leader:	Nicole Messina	Value Stream:	Preop Area
	Event Dates:	12/1/14 - 12/5/2014	Process Owner:	Nicole Messina	Facilitator:	Leonid Gorelik	Event ID:	RPNW1
	Team Members:	Sonja Tennaro Patricia Tischler	Leonid Gorelik Nicole Messina	Pavel Kurasov Andrea Lundy	Maria Tetelina Delicia Palisoc	Redford Mancio		

Box 1: Reason for Action

To improve patient care quality and safety and reduce organization costs by identifying process impediments to patient flow to the operating room using Lean process improvement methods

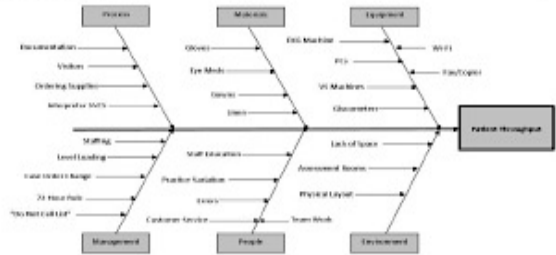
Scope
 October - December 2014
Exclusion
 None
Start
 Oct-14
End
 Dec-14

Box 2: Current and Target Condition

S.N.	Metric	Current	Target
1	Reception Desk (min)	<1	<1
2	Waiting Area I (min)	8	<5
3	Dressing Room (min)	13.2	<10
4	Preoperative Waiting Area II (min)	46	<15
5	RN-Assessment (min)	28	<20

Current Condition Description
 Patients travel to care providers. Staff point patients/family members to the location they are looking for. Education is designated to the RNs only. Height and Weight are obtained by asking the patient. Vital signs are obtained in the dressing room, which lacks privacy.

Target Description (What does good look like?)
 All services are brought to the patient. Staff walk patients to areas of the department instead of pointing to the location. While walking the patient/family members, staff utilize the opportunity to complete patient/family education. The dressing room staff will obtain patient's height and weight by using the height and weight scale provided in the dressing room. Vital signs are obtained in a private location. Staff do not argue over which assessment area to use.

Box 3: Analysis


Box 4: Possible Solutions

No.	If We...	Then We...
1	Streamline the NGG assessment	Decrease documentation time
2	Develop standard work process	Decrease variations in practice
3	Obtain pt. vital signs in preop area	Increase patient privacy
4	Bring services to the patient/family	Decrease patient motion and confusion
5	Remove the sign-in sheet at reception desk	Decrease the occurrence of bottlenecks

Box 5: Experiments

No.	Experiment	Result	Conclusion
1	Dressing room staff to obtain accurate Ht, Wt.		Adopt
2	Dressing room staff to walk each patient to pre-op area		Adopt
3	Identify and label each room/location available to conduct assessment		Adopt
4	Develop/design new process to ensure that VS are done privately		Adopt
5	Unit clerk will decide which order patients should be assessed		Adopt

Box 6: Action Plan

Action Item	Responsible	Due Date	Status
Collect data 60 days post-RPNW	P. Kurasov	Feb 1st	
Collect data 90 days post-RPNW	P. Kurasov	March 1st	
Report findings and action plan	L. Gorelik	Jan 21st	
Purchase additional PCs	N. Messina	March 1st	
Implement action plan	N. Messina	March 1st	
Purchase additional VS machine	L. Gorelik	Jan 1st	
Collaborate with IS department	N. Messina	March 1st	

Box 7: Follow - Up

S.N.	Metric	1st Week	10 days	60 days	90 days
1	Reception Desk (min)	<1	<1		
2	Waiting Area I (min)	5 (43%)	5 (43%)		
3	Dressing Room (min)	11 (72%)	11 (72%)		
4	Preoperative Waiting Area II (min)	11 (72%)	17 (50%)		
5	RN-Assessment (min)	11 (12%)	10 (7%)		
	Total	10 (38%)	53 (34%)		

What Worked
 Bringing in a consultant to review the new process before it is implemented. Using lean process methods to identify barriers, important lessons learned after trial and error from implementing experiments. Identifying the role-line and expectations for the trial.

What can be improved
 Engaging other disciplines (Anesthesia and Medicine) in participating in the RPNW. Conducting an RPNW during low patient volume/adequate coverage.

Summary/Key Action
 Collect data 60 days post-RPNW (Feb 1st) and 90 days post-RPNW (March 1st). Continue the process until a state of perfection is reached in which value is created with little to no waste. Disseminate findings and action plan to the preoperative patient flow committee (President's council). Committee members to review, revise (as needed), and implement action plan using a interdisciplinary approach.